Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2016, 8(2):829-833

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Incidence effect by nano spinosad of the invasive *tomato leafminer, Tuta absoluta Meyrick, (Lepidoptera: Gelechiidae)* under laboratory and field condition

Sabbour M. M.[1] and S. M. Singer[2]

[1]*Department of Pests and Plant Protection, National Research Centre, Dokki, Cairo, Egypt*
[2]*Vegetabe Research Department, National Research Centre, Dokki, Cairo, Egypt*

ABSTRACT

The tomato leafminer, Tuta absoluta Meyrick, (Lepidoptera : Gelechiidae) controlled by the biocontrol agent spinosad and its nano particles . under laboratory conditions, the LC50s of the T absoluta Meyrick, (Lepidoptera : Gelechiidae) give, 56, 68, 109, 131, 149, 173 and 175 ppm after Newly hatched larvae, 1st larval instars, 2nd larval instars, 3rd larval instars, 4th larval instars, Adult males and adult females, respectively. Under laboratory conditions, the effect of the nano- Spinosad calculated that, 20, 22, 32, 40, 57 and 59 for the T absoluta for the corresponding stages, respectively. The effect of the tested pathogen under green house effect give a resulted, show, the nano Spinosad gave a significant decrease of infestations after 20, 50, 0 and 120 days after the post application of green house application and recoded, 1.1±3.2, 5 .2±1.1, 9.2±6.1 , and 10.0±4.1 individuals. When th e totato plots treated with spinosad, after the corresponding days the infestation individuals recorded 11.0±5.1, 18. 6±3.1, 31.5±1.8 and57.4±2.9 individuals as compared to 39. 2±6.7, 68.1±5.7, 78.8±9.1 and 99±7.9 individuals in the control. Field condition experiments show that, the amount of the harvest Tomato plant Winter Variety Platenium-5043 in the fields of Fayoum governorates, after nano Spinosad, the weight of tomatoes significantly increased to 16100± 21.60 and 16700± 31.80 kg/ feddan as compared to 15000± 41.11 kg/ fedan in the control. While in Tanta governorates, the tomatoes crop weight16231± 26.40 and17200± 26.70 kg/ feddan in the plots treated with Spinosad and nano Spinosad, respectively as compared to14900± 51.60 kg/ feddan in the control.

Key words: spinosad, Nano, *Tuta absoluta*

INTRODUCTION

The Egyptian crop tomato (*Lycopersicone sculentum* Mill.) considered one of the very important Solanaceous vegetable crops. Tomato planting are currently highly infested with many serious and harmful pests, recently the most destructive harmful one is *Tuta absoluta* [1-8].

The invasive tomato leafminer, *Tuta absoluta* Meyrick, (Lepidoptera : Gelechiidae) considered among the most important pests of the tomato plant in Egypt during the last years[9-12]. Tomato Pinworm *T. absoluta* (Meyrick) (Lepidoptera: Gelechiidae) is posing a very serious threat to the tomato production[13-20]. These tomato pest is crossing borders rapidly and devastating tomato production substantially. The tomato Caterpillars prefer to eat tomato leaves and tomato stems, but may also occur underneath the tomato crown of the fruit and also, even inside the tomato fruits itself of the Solanaceous vegetables. *T. absoluta* larve attack only green fruits of the Solanaceous vegetable crops [21-24]. Among the most distinctive symptoms occur , the blotch-shaped mines inside the vegetable leaves. Inside these mines both the larvae live and eat the plant parts of the crop. In case of the very serious infection, the tomato plant leaves dry leads to die off completely. Mining damage occur to the plant causes its malformation. Damage to fruit allows the fungal diseases to enter to the plant body, which lead to the rotting of fruits before or even after harvest , [1,2] . In Egypt, tomato grown in green house , semifield and open field. *T. absoluta* attacks the tomato fruits severely which causing a highly lose of their commercial value. 50–100% losses have been reported on tomato [3,4]. [5, 6, 7] , used the Biocontrol agent bacteria or fungi for controlling the Tomato Pinworm *T. absoluta* (Meyrick) (Lepidoptera: Gelechiidae) in Egypt. [7,8] control the tomato insect pests by using isolated *Bacillus thuringiensis* and the entomopathogenic fungi. Nano pesticides, nano fungicides and nanoherbicides are being used efficiently in agriculture [9,10, 11].

The aim of this work to evaluate Spinosad and nano Spinosad against *T. absoluta* under laboratory, greenhouse effect and field.

EXPERIMENTAL SECTION

2.1. Rearing insect pests:

The tomato pinworm were reared on tomato leaves under laboratory conditions 22±2Co and RH 60-70% *T. absoluta* used in the trials were obtained from laboratory cultures. The experiments were repeated 4 times. The percentages of mortality were calculated and corrected according to [24], while LC50 was calculated through probit analysis, (Finney, 1964). The experiments were carried out under laboratory conditions 22 ± 2o C and 60-70% R.H. Twenty individuals of the third larvae of *T. absoluta* were put on them, covered with muslin. Control (untreated) was made by feeding the larvae on untreated leaves (sprayed by water only). The experiments were repeated 4 times. The percentages of mortality determined after seven days. The percentages of mortality were counted and calculated according to [24], while Lc50 were calculated through probit analysis [25]. The experiments were carried under laboratory conditions; 22 ± 2o C and 60± 5 % RH.

2.2 Green house trials:

Tomato plant Winter Variety Platenium-5043 was planted in the green house in 40 plots in each artificial infestation was made by spraying the plant with the spinosad at the concentrations of and 5g/l . Control samples were sprayed by water only. The plants were examined every two days, the percentage of infestation was calculated until the end of the experiment. Each treatment was replicated 4 times. The percent mortality was counted and corrected according to Abott, 1925; while Lc50s were calculated through probit analysis after [25]

2.3. Field trials

The experiments were carried out to study the effectiveness of the tested Spinosad and *nano* Spinosad against the target insect pests in two different areas. These two areas were: El-Dakakli and Kafer El shik . Tomato planted Winter Variety Platenium-5043 planted on the end of September in an area of about 1600 m^2, and divided into 16 plots of 50 m2 each. Four plots were assigned for each Spinosad , while 4 plots were treated with water and used as the controls. Spinosad Treated t 5g/ml . Treatments were performed in a randomized plot design at sunset. A five-litre sprayer was used to spray on the treatments. Three applications were made at one week intervals, at the commencement of the experiment. Twenty plant samples were randomly collected at certain time intervals from each plot and transferred to the laboratory for examination. The average number of each of the tested pests/ sample/ plot/treatment was calculated 21, 45 and 120 days after the 1st application. The infestations of target insect pests were then estimated in each case. After harvest, the yield of each treatment was weighed as kgs/feddan.

2.4. Nanoencapsulation

Nanoencapsulation is a process through which a chemical is slowly but efficiently released to the particular host for insect pests control. Release mechanisms include dissolution, biodegradation, diffusion and osmotic pressure with specific pH [26]. Encapsulated of the two isolated bacteria HD-703 and HD-95 nano-emulsion is prepared by high-pressure homogenization of 2.5% surfactant and 100% glycerol, to create stable droplets which that that increase the retention of the oil and cause a slow release of the nano materials . The release rate depends upon the protection time; consequently a decrease in release rate can prolong insect pests protection time [27].

RESULTS

Table 1show that under laboratory conditions, the LC50s of the different tomato leafminer, *T absoluta Meyrick,* (Lepidoptera : Gelechiidae) during its life span which give, 56, 68, 109, 131, 149, 173 and 175 ppm after Newly hatched larvae, 1^{st} larval instars, 2^{nd} larval instars, 3^{rd} larval instars, 4^{th} larval instars, Adult males and adult females, respectively (Table 1).

Table 1.Effect of Spinosad against the different stages of *T. absoluta* under laboratory conditions

Insects	LC_{50}	Slope	variance	95%confidence limits
Newly hatched larvae	56	0.1	1.01	30-69
1^{st} larval instars	68	0.2	1.01	35-98
2^{nd} larval instars	109	0.4	1.01	77-117
3^{rd} larval instars	131	0.3	1.01	97-142
4^{th} larval instars	149	0.2	1.01	101-143
Adult males	173	0.1	1.02	111-198
Adult females	175	0.1	1.02	128-195

Table2 .Effect of Nano- Spinosad against the different stages of *T. absoluta* under laboratory conditions

Insects	LC_{50}	Slope	variance	95%confidence limits
Newly hatched larvae	20	0.1	1.01	30-36
1^{st} larval instars	22	0.2	1.01	15-68
2^{nd} larval instars	32	0.4	1.01	27-99
3^{rd} larval instars	35	0.3	1.01	27-102
4^{th} larval instars	40	0.2	1.01	31-83
Adult males	57	0.1	1.02	29-78
Adult females	59	0.1	1.02	28-95

Table (3): Effect of Spinosad against *T. absoluta* under greenhouse conditions

Treatments	Days after treatment	Means of infestations (Means ± S.E.)
Control	20	39.2±6.7
	50	68.1±5.7
	90	78.8±9.1
	120	99±7.9
Spinosad	20	11.0±5.1
	50	18.6±3.1
	90	31.5±1.8
	120	57.4±2.9
Nano-Spinosad	20	1.1±3.2
	50	5.2±1.1
	90	9.2±6.1
	120	10.0±4.1
F –test	15.4	
LSD 5%	14.8	

Table (4): Weight of harvested tomato into two Egyptian regions after silica gel and nano-silica gel treatment against *T. absoluta* during seasons 2015

Treatments	Fayoum Weight tomatoes (Kg/feddan)	Tanta Weight tomatoes (Kg/feddan
Control	15000± 41.11	14900± 51.60
Spinosad	16100± 21.60	16231± 26.40
Nano- Spinosad	16700± 31.80	17200± 26.70
F –test	36.1	
LSD 5%	19.3	

Figure1. Infestation percentages of tomato leafminer, *T absoluta Meyrick*, (Lepidoptera : Gelechiidae) after different treatments under green house conditions

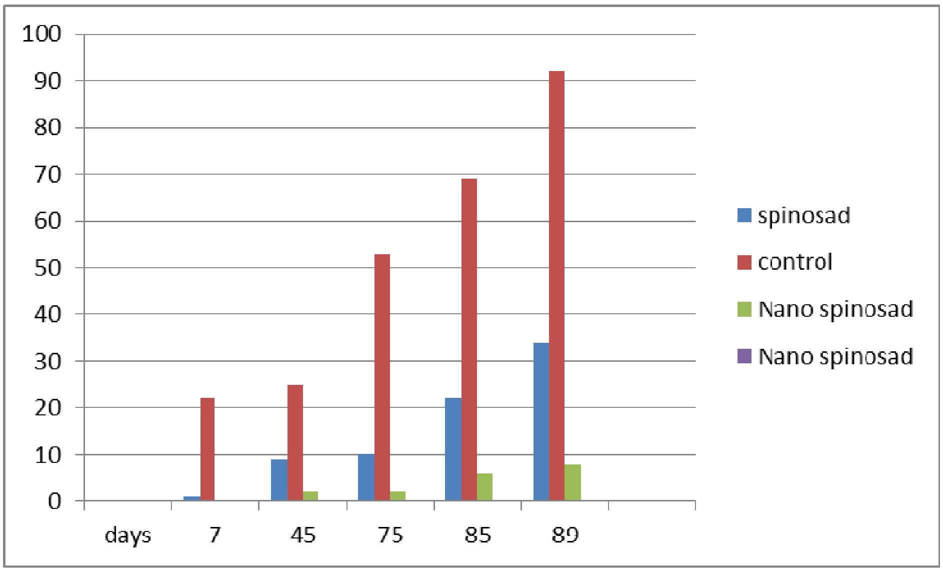
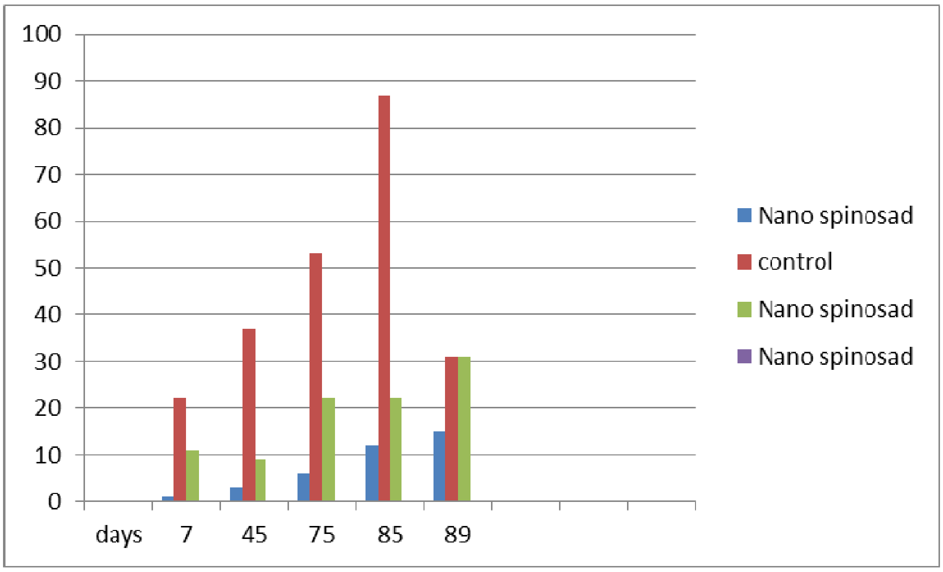


Figure 2 . Infestation percentages of tomato leafminer, *T absoluta Meyrick*, (Lepidoptera : Gelechiidae) after different treatments under field conditions



Under laboratory conditions, the effect of the nano- Spinosad calculated that, 20, 22, 32, 40, 57 and 59 for the *T absoluta* Newly hatched larvae, 1st larval instars, 2nd larval instars, 3rd larval instars, 4th larval instars, Adult males and adult females, respectively (Table 2).

The effect of the tested pathogen under green house effect shown in table 3 which resulted, the nano Spinosad gave a significant decrease of infestations after 20, 50, 0 and 120 days after the post application of green house application and recoded, 1.1±3.2, 5.2±1.1, 9.2±6.1 , and 10.0±4.1 individuals. When the totato plots treated with spinosad , after the corresponding days the infestation individuals recorded 11.0±5.1, 18.6±3.1, 31.5±1.8 and57.4±2.9 individuals as compared to 39.2±6.7, 68.1±5.7, 78.8±9.1 and 99±7.9 individuals in the control (Table 3).

Table 4, show the amount of the harvest Tomato plant Winter Variety Platenium-5043 in the fields of Fayoum governorates, after nano Spinosad, the weight of tomatoes significantly increased to 16100± 21.60 and 16700± 31.80 kg/ feddan as compared to 15000± 41.11 kg/ fedan in the control. While in Tanta governorates, the tomatoes crop weight16231± 26.40 and17200± 26.70 kg/ feddan in the plots treated with Spinosad and nano Spinosad, respectively as compared to14900± 51.60 kg/ feddan in the control (Table 4)

Figures 1 and 2 showed that Infestation percentages of tomato leafminer, *T absoluta Meyrick,* (Lepidoptera : Gelechiidae) after different treatments under green house and field conditions were significantly decreased in both two cases of investions.

Acknowledgment
This research was supported by PROJECT TITLED, BIOLOGICAL CONTROL OF SOME GREENHOUSE TOMATO INSECT PESTS.

REFERENCES

[1] Sabbour M.M.**2014**. *Middle East Journal of Agriculture Research*, 3(3): 499-503.
[2] Sabbour**, M.M. 2009**. Evaluation of two entomopathogenic fungi against some insect pests infesting tomato crops in Egypt , IOBC/wprs Bulletin, Vol. 49: 273-278
[3] Sabbour M.M. and Singer, S.M. **2014**. *International Journal of Science and Research* (IJSR) ISSN (Online): 2319-7064.
[4] Sabbour Magda1 and Maysa E. Moharam. **2015**. *International Journal of Science and Research*.458-462.
[5] Sabbour, M.M and Nayera, Y. Soliman, **2014**,. Evaluations of three *Bacillus thuringiensis* against *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) in Egypt. *Volume 3 Issue 8, August 2014*. 2319-7064.
[6] Sabbour M.M.**2014**. *Middle East Journal of Agriculture Research*, 3(3): 499-503.
[7] Sabbour M.M.**2014**. *Middle East Journal of Agriculture Research*, 3(3): 499-503.
[8] Sabbour**, M.M. 2009**. Evaluation of two entomopathogenic fungi against some insect pests infesting tomato crops in Egypt , IOBC/wprs Bulletin, Vol. 49: 273-278
[9] Sabbour, M.M and Nayera, Y. Soliman, **2014**,. Evaluations of three *Bacillus thuringiensis* against *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) in Egypt. *Volume 3 Issue 8, August 2014*. 2319-7064
[10] Sabbour M.M. and Singer, S.M. **2014**. *International Journal of Science and Research* (IJSR) ISSN (Online): 2319-7064.
[11] Sabbour Magda and Maysa E. Moharam. **2015**. *International Journal of Science and Research*.458-462.
[12] Sabbour M.M. Nayera. Y. Solieman· **2016**. *International Journal of ChemTech Research* Vol.9, No.01 pp 259-266.
[13] Hussein M.M. Sabbour M.M. and Sawsan Y. El-Faham. **2015**. *International Journal of ChemTech Research***. Vol.8, No.12 pp 121-129.**
[14] Sabbour, M.M. **2015**. *International Journal of Scientific & Engineering Research*, Volume 6, Issue 12, December-**2015**. Vol.8, No.12 pp 121-129.
[15] **Sabbour, M.M. 2015.** *Journal of Global Agriculture and Ecology,***: 2454-4205,** Vol.: 5, Issue.: 1
[16] Sabbour M.M and S.M. Singer.**2015**. *International Journal of Scientific & Engineering Research*, Volume 6, Issue 10, October-**2015**. 243-247.
[17] Sabbour, M.M **2015**. *IOBC-WPRS Bulletin* Vol. 111, **2015**. pp. 361-367.
[18] Sabbour, M.M **2015**. Efficacy of nano-extracted destruxin from *Metarhizium anisopliae* against *Sitophilus oryzae* (L.) (Coleoptera: Curculionidae) under laboratory and store conditions. Integrated Protection of Stored Products IOBC-WPRS Bulletin Vol. 111, **2015**. pp. 369-375.
[19] Sabbour Magda and Maysa E. Moharam. **2015**. *International Journal of Scientific & Engineering Research,* Volume 6, Issue 11, November. 140-147.
[20] Sabbour Magda and Maysa E. Moharam. **2015**. *International Journal of Scientific & Engineering Research,* Volume 6, Issue 8, August-2015. 1816- 1827.
[21] Sabbour Magda and Maysa E. Moharam. **2015**. *International Journal of Science and Research*.458-462.
[22] Sabbour Magda and Hussein M.M.**2015**. *International Journal of ChemTech Research* Vol.8, No.9, pp 167-173.
[23] Sabbour Magda1 and Maysa E. Moharam. **2015**. *International Journal of Science and Research* Volume 4 Issue 10, October 2015. 1274
[24] Sabbour M.M. **2015**. *International Journal of Science and Research* (IJSR). Volume 4 Issue 10,1279 -128 .